

SBR Report No. 3-1203

**Bioremediation of Oily Bilge Using
BilgeRemed on board M/V Swift Arrow**

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Executive Summary

M/V Swift Arrow belonging to KGJS of Canada was nominated for a field evaluation of BilgeRemed by the fleet manager. Unlike the [evaluation of BilgeRemed](#) aboard Cape Wrath these trials were conducted on ship during active sailing.

M/V Swift Arrow sailed from Port Kitimat in Northern British Columbia for Japan carrying cargo for delivery. Evaluation of BilgeRemed was carried out with great degree of sincerity by the personnel on M/V Swift Arrow and we are thankful to the Chief Engineer Mr. Mustra for taking efforts. There was a regular maintenance of the log of addition of BilgeRemed and each sample was shipped by the next available delivery to our office for chemical analyses.

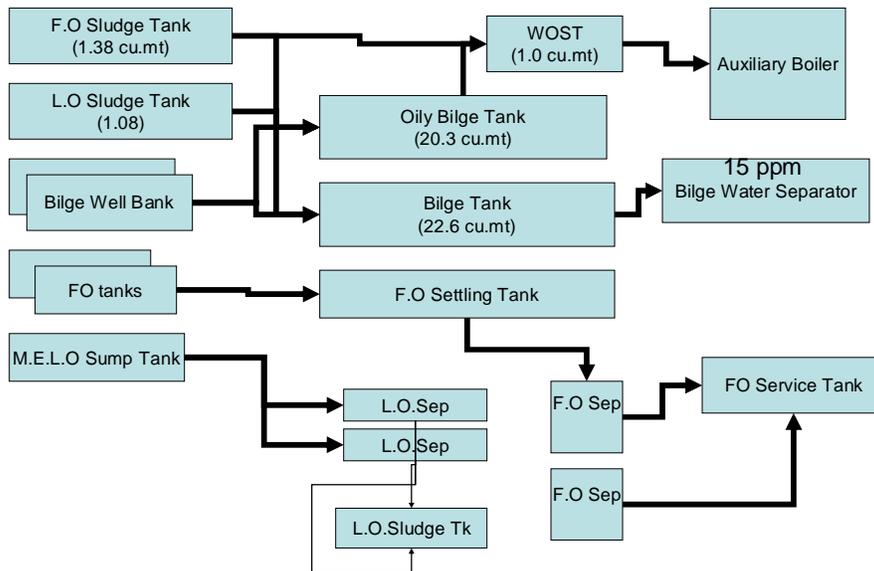
The results are very encouraging. The TPH of the final sample drawn from the ship before entering the port in British Columbia showed the value of TPH as 5.0 ppm and the trial was terminated once the ship entered in harbor. A notable aspect of the study was the increase in TPH of bilge water to 39,000 ppm after 2nd addition of BilgeRemed. Results also showed reduction of free oil in the samples and was reduced to 0.05% from 12.0 % in the second week.

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Introduction

An important operational problem for any ship is the accumulation of oily waste in the oily bilge tank since this water cannot be discharged into open waters. As per the MARPOL 75/77 regulation; the total petroleum hydrocarbon content (TPH) in water that can be safely discharged into open waters should not exceed 15 ppm. This regulation mandates that all ocean going ships be equipped with Oil Water Separators (OWS) and that the outlet of the OWS passes through Oil Content Monitors (OCM). Only waste water containing oil content less than 15 ppm as allowed to be discharged.

Waste Oil/Bilge Water Schematic



The above schematic diagram represents captures the main entry points of waste oil entering the bilge tank. The oil separated from the oily bilge water is collected in a sludge holding tank free of water: Waste Oil Sludge Tank (WOST). The sludge is stored in WOST till the ship reaches port and downloads at port receiving facilities. This is an additional operational cost for the ship. Present report presents results on ship board studies on bioremediation of bilge water using BilgeRemed during sailing. The oil separated from the oily bilge water is collected in a sludge holding tank free of water and is then downloaded at port receiving facilities adding to the operational costs for the ship.

This report discusses the results of bioremediation of bilge water using BilgeRemed while the ship was sailing. During this evaluation it was found that BilgeRemed was not only able to reduce the TPH content to **5 ppm** but also able to sufficiently deal with new addition of oily water on a daily basis.

Objectives

The objective of the present field evaluation is to determine if BilgeRemed can be employed for pre-treatment/treatment of oily bilge water before passing through the oil water separators. Any reduction of oil by the activity of bacteria in BilgeRemed will reduce load on the oil water separators and also accumulation of oily sludge by the ships for discharge in the port receiving facilities. The objectives are summarized below.

1. Pre-treat oily bilge water
2. Reduce load on ship board OWS
3. Reduce accumulation of oily sludge in sludge tank
4. Help reduce marine pollution

Treatment Protocol

It was decided that at the first opportunity for the ship, they should collect sample of oily bilge water before adding 5 gallons of BilgeRemed as a **baseline**. The sample was shipped to us for next day delivery for processing analysis. Every week one sample of oily bilge water is to be collected and shipped before addition of 5 gallons of BilgeRemed. The protocol was diligently followed by the ship except when at shore or in coastal waters when the bilge pumps are not allowed to operate.

M/V Swift Arrow sailed from Port Kitmat in Northern British Columbia on 15th August, 2003. The ship discharged about 6,600 liters of bilge water through their OWS soon after leaving the port and before the beginning of the ship board trial. The ship had a balance of about 1000 liters of oily bilge water. 1 liter sample of water from the tank was collected before addition of BilgeRemed into the tank. 5 Gallons of BilgeRemed was added to the tank through the sounding tube on 17th August and every following week. The ship returned on 22nd September 2003 to Vancouver in British Columbia.

Table 1: Analysis of oily bilge water after treatment with BilgeRemed

No. of Weeks	TPH (ppm)	Bacterial Colonies/ml	Per cent free oil
1	4701	10,000	0.02
2	32940	530,000	0.14
3	10	360,000	0.005
4	5	200,000	0.005

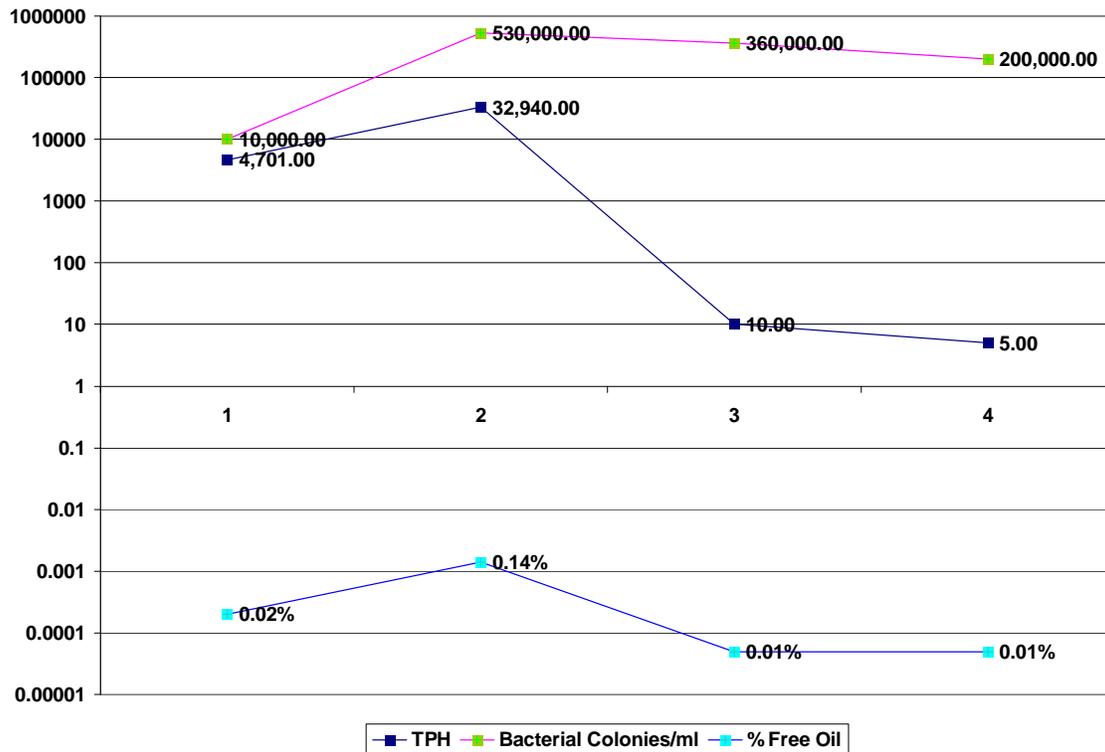


Figure 1. Graphical representation of the parameters analyzed during trials

The results given above indicate that BilgeRemed is very effective for pre-treatment of oily bilge water in ships during its sailing period. Thus TPH of the oil was reduced to 5.0 ppm at the end of the trial before the ship returned to the port. During its sailing, the ship had to pass through typhoon and very cold temperatures. The engineer had to steam the bilge tank to keep the contents in fluid state. Even under these difficult circumstances, bacteria in the BilgeRemed continued to perform.

It was not possible to correlate the reduction of TPH with the accumulation of sludge in the sludge holding tank. But the pretreatment of oily bilge water would certainly have reduced the load on the ships OWS as can be seen from the final value of TPH before ship returned to the port in Canada.

Conclusion

BilgeRemed was quite effective in reducing the TPH content to **5 ppm** successfully. During the process of bioremediation, there was an increase in the free oil percentage and this is probably due to the thinning of oil through the biodispersion process. There was a significant reduction in the population of bacteria when the TPH was reduced to 5 ppm.

BilgeRemed is safe for pretreatment of oily bilge during ships sailing and helps prevent maritime pollution through accidental discharges. BilgeRemed also reduces port time for ships due to reduction of sludge. Another notable aspect of this evaluation is the amount of BilgeRemed applied in the bilge tank: for a *22,600.00 liters only 120 liters* of BilgeRemed was added.

Acknowledgements

We are thankful to Mr. Mario Ramirez-Gaston, Fleet manager for KGJS for support during the shipboard trials. We are thankful to Mr. Mirko Mustra, Chief Engineer Swift Arrow for his active participation in the trial program and detailed feedback.